

Abstract

A purely refractive projection objective suitable for immersion microlithography is designed as a single-waist system with five lens groups in the case of which a first lens group of negative refractive power, a second lens group of positive refractive power, a third lens group of negative refractive power, a fourth lens group of positive refractive power and a fifth lens group of positive refractive power are provided. The fourth lens group has an entrance surface (E) that lies in the vicinity of a point of inflection of a marginal ray height between the third lens group (LG3) and the fourth lens group (LG4). No negative lens of substantial refractive power is arranged between the entrance surface and the system diaphragm (5). Embodiments of inventive projection objectives achieve a very high numerical aperture $NA > 1$ in conjunction with a large image field and are distinguished by a compact design size. For working wavelengths below 200 nm, structural widths of substantially under 100 nm can be resolved when use is made of immersion fluids between the projection objective and substrate.

(Figure 1)